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Recent Terminal Improvements of the Boston & Maine Railroad

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BOSTON SOCIETY OF CIVIL ENGINEERS

Volume XVII JANUARY, 1930 Number 1

RECENT TERMINAL IMPROVEMENTS OF THE BOSTON & MAINE RAILROAD

By Frank C. Shepherd,* Member, Boston Society of Civil Engineers

(Presented at a meeting of the Boston Society of Civil Engineers, December 18, 1929)

The Boston terminal of the Boston & Maine Railroad, with its 200 miles of track, occupies about 650 acres, situated in the cities of Boston, Cambridge and Somerville, that part in the city of Boston proper being separated from the rest by Charles River.

The present terminal is the outgrowth of a combination of four separate and individual railroads entering Boston, in the following chronological order:

Boston & Lowell Railroad	1835
Boston & Maine Railroad	1845
Fitchburg Railroad	1848
Eastern Railroad	1854

Originally each railroad owned and operated separate passenger stations, freight houses and yard facilities, and as late as 1893 there were four separate passenger stations on the north side of Boston, one at Haymarket Square and three on Causeway Street, the original North Station on Causeway Street being opened in 1894.

Single operation by the Boston & Maine Railroad came in 1900, resulting from the lease of the Boston & Lowell Railroad in 1887, the acquisition of the Eastern Railroad in 1890 and the lease of the Fitchburg Railroad in 1900. Single ownership came from a consolidation in 1919, at which time the Boston & Maine Railroad acquired ownership of both the Lowell and Fitchburg railroads.

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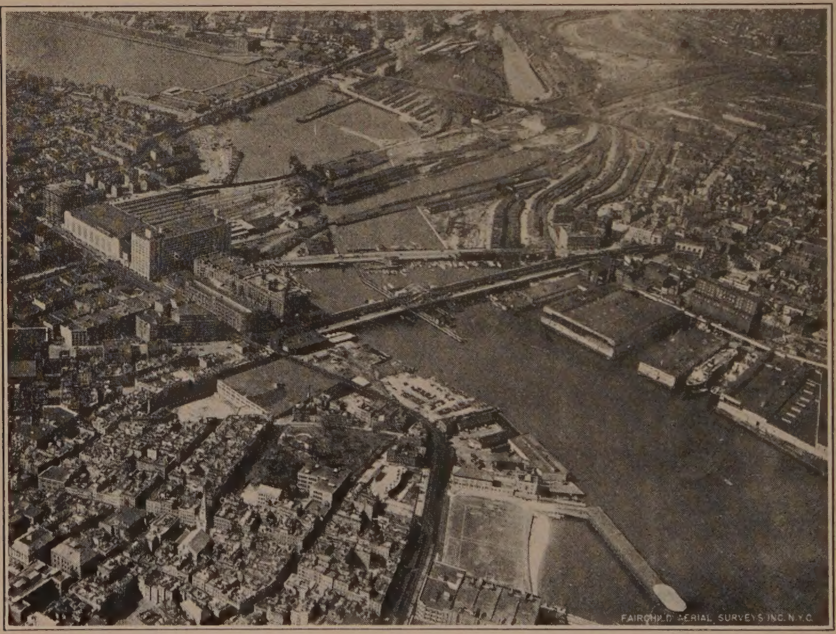
* Consulting Engineer, Boston & Maine Railroad.

While for years necessary improvements and changes in the Boston terminal had been under discussion, and many plans and studies had been made, it was only after the railroads came under single ownership that changes of any magnitude could be undertaken. At that time the railroads in the country were still under Federal control. Emerging from Federal control in 1920, the Boston & Maine Railroad, as did nearly all the railroads, found itself without money for needed improvements, and it was not until 1926, through financial reorganization, that the railroad finally found itself in a position where the developments needed and discussed for many years could be started.



Courtesy of Fairchild Aerial Surveys, Inc.

FIG. 1. — AERIAL VIEW OF TERMINAL IMPROVEMENTS

During the last four years there has been great activity on the part of the Boston & Maine Railroad in the rebuilding and remodeling of its terminal in Boston, and further improvements which are now contemplated mean at least two years more of such activity before all these changes will be finally completed. It is the purpose of this paper to discuss in a general way the principal improvements which have been made or which are now under way.

New Freight House Facilities and Classification Yards

Beginning in 1926 the Boston & Maine Railroad, at an expense which probably will be in excess of $6,000,000, has been gradually developing new freight house facilities and classification yards in its Boston terminal.

While operating as one road, the Boston & Maine Railroad has operated over and served the public through the separate track and freight facilities of its four principal constituent roads, crowded into irregular and congested areas of land and water, and has been forced to meet the present day transportation conditions of motor and rail co-ordination with facilities which were originally laid out for the primary purpose of providing rail-water connections.

There are four separate feeders to the Boston terminal, — the Fitchburg Division from the west bringing in freight from the western gateways at Mechanicville, Rotterdam Junction, Troy and Bellows Falls; the Southern Division from the north bringing in freight from the northern gateways at White River Junction and Wells River; and the Portland Division — eastern and western routes — bringing in freight from the eastern gateway at Portland. All freight trains coming in over these various lines entered separate classification yards in Boston, where, after flat switching, the cars were placed at the various freight houses or bulk delivery yards, or assembled in trains for forwarding east, north or west.

As the classification yards were separated, so were the freight house facilities. The Fitchburg Division freight house facilities were located, practically all on pile structures, in houses known as Nos. 10 and 11 on the north side of the Charles River, west of Warren Bridge and approached from Beverly Street just north of the old Fitchburg passenger station by a driveway leading over a drawbridge across the Charles River. The Southern Division freight house facilities were located in Boston in the old Minot Street yard, in houses Nos. 1 to 6, and reached by tracks over a long pile trestle and drawbridge across the Charles River. Another set of houses, known as Nos. 7 and 8, were located north of the Charles River in Cambridge, with access from Bridge Street. The freight house facilities of the two Portland Divisions are in Charlestown on Front Street and along Rutherford Avenue.

The excess cost to the Boston & Maine Railroad in maintaining forces at all these separate houses is apparent, and the excess cost to shippers in trucking to and from the various freight houses had long been evident. The seriousness of this is better appreciated when it is realized that under the old conditions truckmen in some instances would have to go to four distinct freight house districts — Minot Street, East Cambridge, Warren Bridge and Rutherford Avenue — in order to deliver a single load of L. C. L. freight, with a separate door for each destination, this situation making it necessary in some instances for a teamster to make as many as fourteen stops in distributing a single load of freight. Further, excess switching and handling of cars through the various classification yards and across the main lines of passenger traffic had always been a source of expense and delay.

In developing plans for the new freight house facilities and classification yards, there were two points always before the engineers — first, the improvement and expediting of freight service enabling the Boston & Maine to better serve the public and the industries of New England and to recover traffic which had been lost to motor truck and other competitive agencies, and second, to enable large operating economies to be effected through the co-ordination of freight houses and yards and other facilities which in return would materially reduce switching and the necessary handling of freight. For the most part this latter problem has been due to the difficulty of interchanging freight from one division to another, through existing track arrangements; the lack of co-ordination between inbound and outbound freight house facilities of the four divisions, which has necessitated extensive transfer movement within the terminal; the crossings of the tracks of the Boston & Albany Railroad, which cut across the terminal; and the difficulty of clearing through the terminal for the movement of the 365 passenger trains which the Boston & Maine Railroad operates daily into and out of the North Station.

There was, as well, the consideration of the general increase in traffic without any increase in facilities; records showing that while in 1920 the average number of freight cars received at Boston daily was 1,000, there was a daily average of 1,430 cars received in the year 1928.

After months of careful study and investigation it was finally determined that all freight house work should be consolidated, and that this concentration of facilities should be in East Cambridge, just across the Charles River from the North Station, a location selected because of its close proximity to the Northern Artery, to the proposed new loop highway, and with direct access to the business and industrial districts of Boston. For the same reason the main bulk delivery yards of the various divisions are to be concentrated in this same district, although there will be auxiliary bulk delivery yards in units of moderate size located at other points attractive to the receivers and shippers of freight in the various localities.

In the new freight house facilities at East Cambridge all Fitchburg and Southern Division inbound L. C. L. freight is now handled in the old Southern Division freight houses Nos. 7 and 8, and the outbound L. C. L. freight for those two divisions has been concentrated in a new outbound freight house and warehouse, 640 feet long and 50 feet wide, located just east of the Northern Artery and extending under the Prison Point Bridge. This freight house is divided into three sections — a two-story unit 360 feet long, a one-story unit 80 feet long, and a 200-foot concrete unit, six stories in height, the upper five stories with elevators serving as a storage warehouse. The second floor of the two-story unit is used for a freight office and for the storage of records.

The track layout in connection with the new outbound freight house and warehouse consists of 12 stub tracks, these tracks being on the east side of the building and arranged in two groups of 6 each, separated by a 700-foot transfer platform 30 feet wide and served by an additional platform of the same size on the east side of the outermost track. This latter platform, trucking access to which is afforded over a wide driveway along its entire length, is in direct contact with the intermediate platform and freight house through a connecting platform at the south end of the stub tracks.

Bulk delivery is handled on tracks in the vicinity of the new freight house, formerly used for Southern Division bulk delivery, and in a new yard built at Water Street in Cambridge. In this new yard there is an unloading crane of 40 tons' capacity and a platform 340 feet long for the unloading of automobiles.

In order to provide for these facilities, the use of the old Southern Division main line through East Cambridge has been discontinued and a new double track line built direct from Prison Point Bridge to Washington Street, Somerville, with a bridge spanning the Boston & Albany tracks. All the Fitchburg and Southern Division freight is now handled at East Cambridge. The ultimate development contemplates bringing the Portland Division freight to this same locality, but before this can be done it will be necessary for the railroad to create additional lands, which is now being done through the filling in of an area of some 500,000 square feet in the Charles River, which will then allow the necessary extension of the freight house facilities and bulk yard tracks.

The concentration of classification facilities has been accomplished through the construction of two large classification yards, located in Somerville near Washington Street, one for inbound and one for outbound freight, both yards using gravity for switching, with humps for acceleration. The new Southern Division passenger mains running from Prison Point Bridge to Washington Street separate the two yards — Yard 8 on the west being the inbound and Yard 9 on the east being the outbound classification.

The entrance to the inbound classification yard is over the main lines of the Southern Division through Somerville. Through connection at Hills Crossing in Belmont the Fitchburg Division freight trains now pass over the old Massachusetts Central Railroad through North Cambridge, and then over the Lexington Branch of the Southern Division to the main lines of the Southern Division at Somerville Junction, and thence to the classification yard. Over the old line between Wilmington Junction on the Portland Division and Wilmington on the Southern Division all Portland Division freight trains on the Western Division and from the Eastern Division — east of Salem — now reach this new classification yard over the Southern Division main lines.

The inbound classification yard was originally built with 6 receiving tracks averaging 3,100 feet long and 25 classification tracks averaging 1,930 feet long. This year 10 additional classification tracks averaging 1,800 feet long are being installed. In this yard all inbound trains are classified and moved to points of destination, — either freight houses or bulk delivery yards, private tracks, interchange with the Boston & Albany or for movement out. In connection with the new inbound classification yard a large car repair yard, with 10 tracks and necessary buildings for housing machinery and other equipment, has been provided.

In the outbound yard there are 8 receiving tracks averaging 2,650 feet long and 30 classification tracks averaging 1,980 feet long. Here, after proper classification, the Fitchburg Division trains pass under the bridge which carries the Southern Division main line over the Boston & Albany tracks and then proceed west through Cambridge. The Southern Division freight trains pass through East Somerville and over the Portland Division west to Lowell Junction, and then over the old Andover & Lowell Railroad to the Southern Division main lines at Lowell. The Portland Division trains east and west pass to their respective lines at East Somerville.

In both of these yards the switching is done by gravity from humps located at or near Washington Street, and all the classification is controlled by electro-pneumatically equipped towers, which operate the various switches as well as the car retarders which have been installed for handling the cars, replacing the old type hump riders who rode the cars and stopped the same by using the hand brakes. In the inbound yard there are three towers operating fifteen retarders, and in the outbound yard two towers operating nine retarders. This means that outside of the cutting of the cars for classification at the hump all classification work is practically done by the five tower operators, which results in a very large saving annually over the old methods of throwing switches by hand and handling cars by hump riders, and a further marked speeding up in the breaking up of the trains, the average train being classified in from one to one and a half hours.

In connection with the new classification yards a large milk depot with driveway access from Washington Street in Somerville was built near the outbound classification yard, this milk depot, with four paved driveways, three platforms and eight tracks, having a capacity of approximately 75 cars.

The late President of the Boston & Maine Railroad — Mr. George Hannauer — was the co-inventor of these retarders and was responsible for their development and use in Boston.

New Engine Terminal

The Boston & Maine Railroad is this year building, at an estimated cost of $1,500,000, a new and modern 50 stall engine terminal as part of its general Boston terminal improvements. This terminal is to be located in Somerville about 1,000 feet north of Millers River Basin, and in an area between the tracks of the Boston & Albany Railroad, the new main lines of the Southern Division and the main lines of the Fitchburg Division.

As there were originally separate freight house and yard facilities, so there have always been the separate engine house facilities built by the original railroads. The Boston & Lowell engine house is in East Cambridge, opposite Lechmere Square. The Boston & Maine engine houses are in East Somerville near Cambridge Street, and the Fitchburg engine house, which is to be abandoned and removed, is in the general location where the new terminal is being located. All these old engine houses have been built many years, and while extensive improvements were made on all of them in 1918, they are too small for the present type of heavy freight locomotives, and are not easily accessible to the freight classification yards.

This new terminal is to be used primarily for the large freight locomotives and the locomotives now used on through passenger trains. The new freight locomotives are over 97 feet long, and at the present time

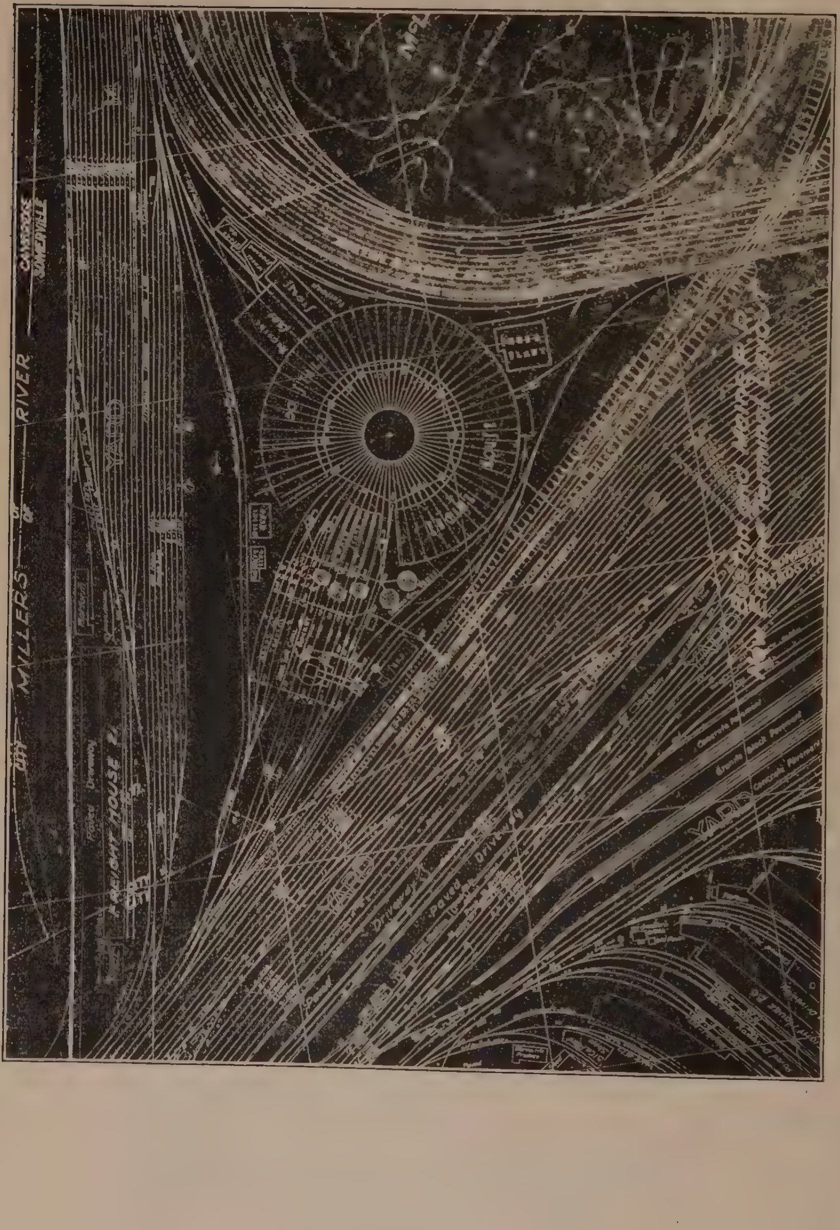


FIG. 2. — NEW ENGINE TERMINAL

cannot be turned on any of the turntables at the old engine houses, nor are the houses themselves long enough to accommodate these locomotives.

This new engine terminal will have the following facilities:

A 50-stall engine house, each stall being 120 feet deep and having a pit 100 feet long. This house is being built in accordance with the predominant standard type of engine house construction, with brick and concrete back walls and metal sash and wood frame and plank roof with transite smoke jacks.

An electrically operated three-point bearing turntable 110 feet long, the center of the turntable pit being 150 feet from the front of the engine house.

A reinforced concrete coal pocket of 2,000 tons' capacity, capable of raising 150 tons per hour into pockets by means of two unit skip hoist elevators. In the coal pocket there is to be a magnetic separator for removing "tramp" iron from the coal as it dumps into the bins. There will also be in this coal pocket a dry sand bin of 60 tons' capacity.

Three deep-water type, cinder pits, 24 feet inside diameter and 20 feet deep, sunk in place by cylindrical caisson method. Cinders are to be loaded from pits to cars by locomotive cranes.

A power plant 88 feet by 89 feet, of steel and brick construction, equipped with three 750 horse power boilers, with room for an additional boiler. These boilers will be Heine water tube type and burn pulverized coal, which will be elevated to a 200-ton suspended bunker by skip hoist and belt conveyor, from which the coal will pass to the pulverizers. Ashes from the boilers will be handled by skip hoist directly to cars. There will also be in this power plant two air compressors capable of supplying 2,000 cubic feet of air per minute at a pressure of 100 pounds per square inch, with after-coolers and air receivers; and a pump room, housing feed water heaters and other heaters and equipment for washing and filling locomotive boilers. For this plant a red brick radial smoke stack 250 feet high is being built. The plant is also to be used as a central steam plant for the entire Boston terminal north of the Charles River.

A sand plant capable of storing 2,700 cubic yards of green sand and fitted for drying sand at the rate of 32 cubic yards per twenty-four hours, the operation of which will be wholly automatic and the first installation of its kind.

A machine shop annex to the engine house, 112 feet by 130 feet, of steel and brick construction, with drop pit, two engine pits and two overhead cranes, one of 5 tons' and one of 15 tons' capacity. This shop will also be equipped with all necessary and modern machinery found in such plants.

Timber wash stands for washing engines on the way to the house.

A brick office building two stories in height, 42 feet by 70 feet, with offices on the lower floor and toilets, showers and locker rooms on the second floor.

Two steel water tanks of 200,000 gallons' capacity.

The area on which this new terminal is being located was originally covered by tide water, but was filled in many years ago. As a result of careful investigation it was decided that concrete pile foundations should be placed under all structures, and for this work Raymond concrete piles have been used, the only exception being that under the coal pocket caisson piles were used.

The engine house development is novel in that it is one of the first of the smokeless type built in this section of the country. As the incoming engines approach the house all fires will be dropped at the cinder pit. The engines, under the remaining steam pressure in their boilers, will then pass over the turntable into the house. In the house there are to be direct steam connections at every stall, and there will also be ten outside steam connection stations. This means that the engines will be under steam during all the time that they are in the house, but there will be no smoke or dust, resulting in a clean, smokeless house, which will greatly facilitate work in the house.

When the engines are marked for departure it will be possible to put them from a fireless condition in the house to road duty in thirty minutes, resulting in considerable economy, both in the use of fuel and in the time of dispatching.

NEW NORTH STATION

It has been previously noted that there were originally four separate passenger stations on the north side of Boston. As late as 1893 these stations were still operated independently, — the Boston & Maine Station in Haymarket Square, where the City Relief Hospital now stands; the Boston & Lowell Station on Causeway Street, corner of Nashua Street; the Eastern Station on Causeway Street, just west of the Boston & Lowell Station; and the Fitchburg Station on Causeway Street between Haverhill and Beverly streets.

In 1894 the original North Station was opened on Causeway Street, between Nashua and Haverhill streets, and the Boston & Maine Station in Haymarket Square was abandoned and later sold to the city of Boston, to be used in connection with subway construction; the Fitchburg Station was abandoned for station purposes but retained until 1926 for office purposes. In building the North Station the old Boston & Lowell Station was retained and became a part of the new station. The old Eastern

Station was removed, and in order to complete the new station a new waiting room was built at the corner of Causeway and Haverhill streets and connected with the Lowell Station by cab stand and sheds, so as to make one large Union Station, in which there were 23 passenger tracks. Wings on Nashua and Haverhill streets were built for baggage, mail and express facilities and also for office rooms on the upper floors. While built primarily as a temporary proposition, this station stood until 1928, and for years handled the largest passenger traffic of any single operating railroad in the country, single operation, as previously noted, coming in 1900. The following figures show the number of passengers in and out yearly:

1900	22,322,710
1910	26,205,905
1920	33,913,600
1928	22,820,377

The drop since 1920 shows the effect of automobiles and busses, which is general throughout the country.

The present North Station, which was built in 1928, was made possible largely by three very important arrangements. The first of these was a contract made in 1927 between the Boston & Maine Railroad and the Boston Madison Square Garden Corporation, whereby the railroad agreed, in connection with its new station building, to construct over a portion of same a coliseum with its floor not more than 24 feet above the level of the street, said coliseum to be substantially the same character, structure, size and specifications as the Madison Square Garden in New York, and the Boston Madison Square Garden Corporation agreed to lease this coliseum from the railroad for a period of twenty-five years.

The second was an agreement reached with the city of Boston whereby the city agreed to widen Causeway Street between Nashua and Beverly streets to a width of 95 feet, to which the railroad has added on its own premises a 15 foot arcaded sidewalk. The city also agreed to widen Nashua Street from 50 to 92 feet, and to extend Nashua Street with the 92 foot width from Minot Street to Leverett Street opposite Charles Street, thus giving a new wide approach to the station and coliseum from the south side of Boston through Charles Street, and from Cambridge over the Northern Artery and the Charles River Dam. In all these improvements the land for the widenings was given by the railroad at one-half its assessed value, and the money received from the city applied to the cost of construction of the new station.

The third was that of the closing by the city as a public way that part of Haverhill Street north of Causeway Street, thus allowing the railroad to build the new station square with Causeway Street.

On Causeway Street between Haverhill and Nashua streets there has been built a new and modern railroad station, with a frontage of 434 feet from Haverhill Street west. At the corner of Causeway and Nashua streets the Boston & Maine Railroad in 1929 sold to the North Station Building Company, Inc., an area of 12,384 feet of land, on which, together with air rights over the station concourse in the rear, this company is erecting a sixteen-story hotel with 500 rooms, which will have a frontage of 116 feet on Causeway Street and 156 feet on Nashua Street. This hotel is being built to conform with the station, thus creating to all purposes a single structure covering the entire frontage of 550 feet between Haverhill and Nashua streets. The hotel will have direct access from Causeway Street, direct access to the station concourse on the street level and to the coliseum at its floor level.

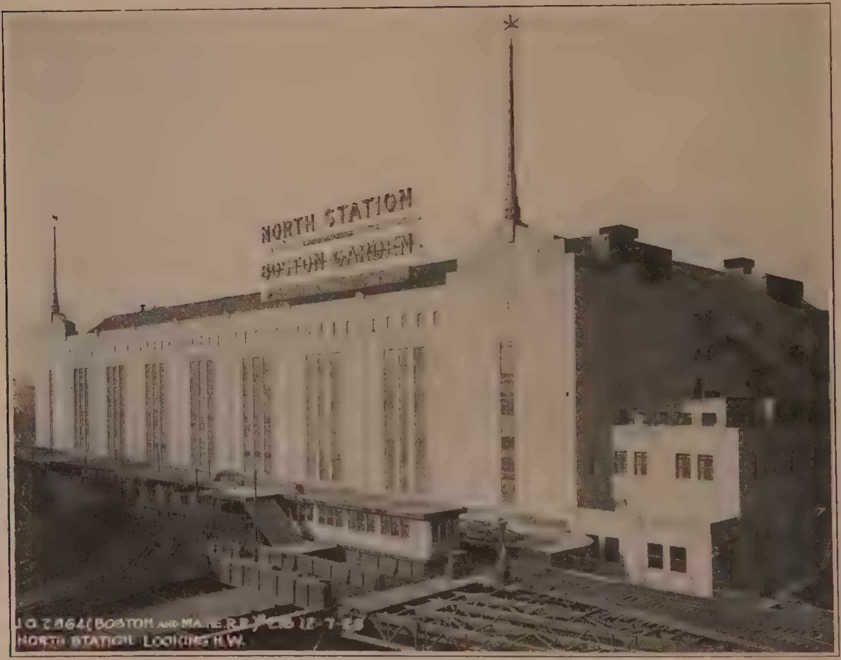


FIG. 3. — NORTH STATION AND BOSTON GARDEN

To the station there are three main entrances, 40 feet wide, at the street level from Causeway Street, and there is to be another entrance from Nashua Street at the west end of the concourse under the hotel, as well as a cab entrance under the hotel at this end. From each of the two Boston Elevated Railway stations on Causeway Street there is a ramp which connects directly to the station concourse and a stairway to the mezzanine floor in the station waiting room and then to the main floor, and there is also a direct approach to the coliseum.

At each end of the new station there are two ramps, one leading from the sidewalk on Causeway Street to the coliseum floor and one from the station concourse to the coliseum floor, all the ramps being built with approximately 12 per cent grades. On the ground floor of the station there is a concourse 60 feet wide by 440 feet long, with train announcing boards and train gates located on the north wall connecting directly to the track platforms. The concourse is entirely closed and heated. The waiting room for the station is parallel to the concourse, and lies between it and Causeway Street, and is 40 feet wide by 260 feet long, with a mezzanine floor on the street side. On the main floor between the concourse and the waiting room there are located the ticket offices, the information bureau, telegraph office, parcel check room, telephone room and concession spaces, and between the waiting room and the street, both on the street and mezzanine floor levels, there are stores for rental. The toilet rooms, barber shop and travel bureau are on the mezzanine floor. A three-story section on Haverhill Street provides baggage space on the ground floor, work space for the coliseum facilities on the second floor and club rooms and offices for the Madison Square Garden Corporation on the third floor.

The coliseum is directly over the station and is identical in size with the Madison Square Garden in New York, being 205 feet wide and 360 feet long. In the arena the main floor is 110 feet wide and 245 feet long, with equipment for freezing ice on the floor whenever required. The seats are arranged around the arena in stadium form, with one large balcony extending completely around the building and another balcony on each side. The main entrances and ticket lobbies are on the arena floor at each end, connected by a main foyer along Causeway Street. The main entrance and ticket offices are reached by a ramp from the sidewalk, a ramp from the concourse and a direct connection from the Boston Elevated Railway Station. Ample stairways at each of the four corners of the coliseum provide full exit facilities, as required for theatre construction, on the basis of 20 feet in width for each 100 persons for whom seats are provided. In addition to these stairways there are fire escapes also accessible from all levels. The total seating capacity of the coliseum is 18,000 for boxing and 14,500 for hockey.

The entire station and coliseum building is of fireproof construction throughout, with concrete foundations, floor slabs and seat banks. The structural frame is entirely of steel, fireproofed with masonry. The entire load of the building is supported by Simplex concrete piles carrying an allowable maximum load of 30 tons each without reinforcement, driven through the old harbor mud and fill to hard bearing strata, at a depth of about 50 feet below the street level. The clear span of the roof trusses is 175 feet. The station finish has been worked out with simple and effective architectural lines. The floors are terrazzo and the walls are Botticino marble for a height of 7 feet, with tinted cement stucco above this line, and the ceilings are also tinted cement stucco. In the coliseum the principal floors are terrazzo, the remaining being granolithic. The walls of the main entrance and foyer are plastered and decorated, the balance of the walls being smooth, hollow tile painted. In order to insure a type of roof in the coliseum which would act as a sound-deadening element, making it possible to use the coliseum for various types of entertainments, a layer of "Acoustex" one inch thick was used under a $2\frac{1}{2}$-inch reinforced gypsum slab, which is covered with asbestos roofing material, the "Acoustex" being fireproof and sound absorbing.

In the construction of the new station and coliseum the following is a partial list of materials used:

Concrete piles	1,518 piles, average length 42 feet.
Concrete	15,000 cubic yards.
Structural steel	4,000 tons.
Reinforcing steel	1,600,000 pounds.
Face brick	600,000
Terrazzo floor	102,000 square feet.
Roof area	100,000 square feet.
"Acoustex" soundproofing in roof	74,000 square feet.

The heating and ventilating systems for the station and coliseum are separate, the station being heated by large fans at each end of the waiting room and concourse supplying fresh air, filtered and heated as required. Through floor registers in the center of the waiting room separate exhaust is provided with unit heaters delivering again to the center of the concourse. Direct radiation is used in all the rental spaces. In the coliseum the heating and ventilating system has been designed to meet the variable conditions under which such a system must operate. Five fans supply fresh air at the rate of 70,000 cubic feet per minute each, and eight fans exhaust the air, four of 70,000 cubic feet and four of 13,000 cubic feet capacities. The eight exhaust fans and their duct systems have been especially designed to clear the coliseum of smoke and haze at boxing exhibitions and at the hockey games. All the air used for ventilation is filtered through oil filters flushed with oil automatically and then heated where the controls provide for any temperature between the range of 40 and 70 degrees F. when the outside temperature is zero.

The floor of the arena has been equipped with a complete brine piping system to provide an ice floor surface for hockey and public skating. Brine for this system is delivered through 10-inch supply and return mains from a refrigerating plant at Minot Street. The ice floor required 13 miles of $1\frac{1}{4}$-inch piping laid on 4-inch centers, embedded in a special concrete floor, and when necessary ice can alternate with other events not requiring ice on successive evenings. The concrete floor containing the pipes is entirely separate from the supporting slab underneath and from the arena walls on all sides, so that the entire floor is free to expand or contract independent of the main structure.

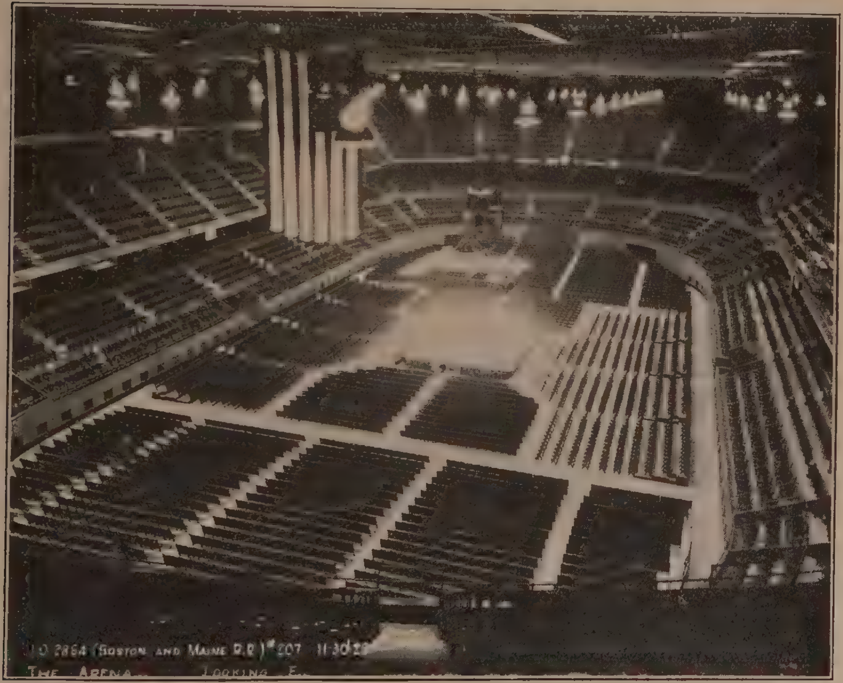


Fig. 4. — Interior of Coliseum

The steam for the heating and ventilating is supplied directly by the Edison Electric Illuminating Company through connections from Nashua Street. Electric service is also obtained from the Edison Company at a sub-station erected on Nashua Street, from which alternating current at 4,000 volts is furnished for the entire station and coliseum. Direct current, however, is supplied by direct connection from the Edison Company lines. In making the electric installation over 26 miles of conduit and 100 miles of wire were used in the distribution system.

In constructing the new station and coliseum it was, of course, necessary that there should be no interference with the public use of the station, nor to the movement of passenger trains in and out of the station, carrying from 80,000 to 90,000 people daily. Demolition of the old buildings was started on December 3, 1927, and with temporary facilities for passenger service, work was carried on without interruption and with no delays to trains at such a rate of speed that the new station was opened for service on August 20, 1928, and the opening event in the coliseum held on November 17, 1928.

In order to provide necessary facilities for baggage and mail a new three-story building 90 feet wide and 150 feet long was built on Haverhill Street adjoining the new station, this building being designed and constructed so that it can be at a later date carried to thirteen stories. From the first and second floors of this building, by means of ramps, mail, express and baggage is handled to a baggage runway on the north side of the new station and thence by ramps directly to the station platforms. The baggage ramps are built with a 7 per cent grade. The baggage runway is on the northerly side and over the new station concourse back of the train gates, so that people passing from the concourse to the trains pass under this baggage runway, doing away with the inconvenience formerly existing where baggage and passengers were handled on the same level.

The construction of the new station and baggage building represents an expenditure of approximately $4,500,000.

Filling Trestle Areas

Old maps show that more than 55 per cent of the area now occupied by the Boston terminal was originally covered by tide water. While much of this water area has been filled in back of sea walls, there still remained in 1925 nearly two million square feet of pile trestle construction supporting tracks and other facilities, including six drawbridges, two over the entrance to Millers River Basin and four across the Charles River.

The question of the filling in of these trestles had been under consideration by the railroad for many years. In 1925 the Boston & Maine Railroad, through the purchase of all the remaining private property on Millers River Basin, became the owner of all property adjoining tide water in the Charles and Millers rivers within the limits of Warren Bridge and the Charles River Dam, and consequently was in a position to start actual filling in of that area.

Following conferences in 1925 between the representatives of the Metropolitan Planning Division and the railroad, the first step towards the changing of the existing harbor lines and the filling in of the trestles was embodied in a special report made in December, 1925, by the Metropolitan Planning Division to the State Legislature, which embodied a draft of a bill for the establishment of new harbor lines in the Charles River in the cities of Boston and Cambridge.

At the first hearing before the legislative committee on this bill, the railroad submitted tentative plans for a new channel in the Charles River between Warren Bridge and the Charles River Dam. As a result of conferences with representatives of the Cambridge Chamber of Commerce, private interests of Cambridge and the navigation companies, an agreement was reached providing that a channel 300 feet wide should be established between Warren Bridge and the Charles River Dam, and that with this channel established there would be no objection to filling in solid the remaining waterway areas, leaving, of course, ample area for the discharge from the overflow culverts at the westerly end of the Charles River Dam.

In 1926 a new harbor line on the northerly side of the Charles River was adopted by the State, and in January, 1927, a new United States pierhead and bulkhead line was established by the War Department, which practically coincided with the line adopted by the State. In 1927 the State adopted a new harbor line on the south side of the river, providing for a 300-foot channel, as originally proposed. The matter of the establishment of a United States pierhead and bulkhead line on this side has been under consideration by the War Department for some little time. At the first hearing before the Board of Army Engineers sitting on this matter, it developed that while the Board favored the general proposition of a new and narrow channel, it felt that it could take no action until the railroad had developed and presented plans for the drawbridges necessary to carry its tracks over the new channel. As conditions existed in 1926 navigation from Warren Bridge to the Charles River Dam passed, first, through a highway drawbridge giving access from Beverly Street to the old Fitchburg Railroad freight houses; then through a single track drawbridge serving industries in Beverly Street and the interchange with the New Haven Railroad through the Union Freight Railroad; then through a 4-track and also an 8-track drawbridge serving the passenger station, and then through a 4-track drawbridge which served the old Southern Division freight houses at Minot Street, these bridges carrying 40-foot openings. As a result of the changes in freight house facilities the first and the last of these bridges were discontinued and removed in 1927. The new channel when established will close the other three. The present track bridges are the old jack-knife type built many years ago, and not only expensive to maintain and operate but slow in opening, which has always been a serious objection, both to passenger service and water transportation.

As a result of the position taken by the Army Board the railroad has now developed plans for new drawbridges with a 65-foot clear waterway, to be erected over the new channel, the plans providing for five rolling lift sections, four carrying two tracks each for passenger service and the fifth carrying one track, which is to be the connection with industries in Beverly Street and the New Haven interchange. Between the new drawbridges and sea walls which are to be built on the new pierhead and bulkhead lines, tracks are to be carried on solid floor creosoted timber trestle construction. In view of the pile construction and the subsequent narrowing of the water way the Army Board will provide for a channel 375 feet wide instead of 300 feet, adopted by the State.

Passenger train operation in the North Station has always been handicapped through the location of the present drawbridges, necessitating so many short tracks and with only a few tracks long enough to handle the heavy trains. With the new drawbridge located some 400 feet farther north, plans have been developed which will result in the rearrangement of the 23 passenger tracks now serving the North Station so that most of these tracks will be able to handle from 13 to 16 car trains.

The work of filling in the trestle areas started in 1927, and has been carried on actively ever since, the result being that up to the present time about a million and a quarter square feet have been filled in, this work requiring about a million and a half cubic yards of filling and leaving about one million yards yet to be placed to fill in the trestles and to create the additional lands. When this work is completed there will remain only 80,000 square feet of timber trestle in the Boston terminal and the railroad will then, in addition to the filling in of the old timber trestles, have created approximately 900,000 square feet of additional solid land. About one-third of the filling placed has been obtained by steam shovel in the removal of the McLean Asylum Hill, which was being done in connection with the new classification yards, while the other two-thirds is rubbish obtained in connection with the demolition of the old North Station and the old Fitchburg Station, city refuse, miscellaneous waste material and dirt, and other material collected along the railroad and brought in by cars, resulting, of course, in a very moderate cost for the filling.

To retain the fill, both on the north and south sides of the river, sea walls are being constructed, the first section, about 600 feet long, having been built entirely of stone found in the removal of the old Fitchburg Station.

The progress in this work was made possible largely by the wonderful co-operation rendered by the United States district engineers and by the Massachusetts Department of Public Works.

The filling, when completed, and the new drawbridges and track changes will require an expenditure somewhat in excess of $4,000,000.

Fruit and Vegetable Terminal

The city of Boston ranks third among all the cities of the United States as a market for fresh fruit and vegetables. Records show that in 1928 there were received in Boston nearly 37,000 cars of fruit and vegetables. The Boston & Maine Railroad handles the bulk of all the citrus fruits, grapes and potatoes for the Boston market.

Nearly all of the citrus fruits are distributed through auction sales, and for many years the auction rooms were located in one of the old Fitchburg Division freight houses on Warren Bridge. Conditions here had been inadequate for some time, so that, to protect itself against loss of business, the Boston & Maine Railroad, in 1927, built on Rutherford Avenue one of the first of the modern type of fruit and vegetable auction terminals in this section of the country, and, at the same time, in the rear of this terminal developed a yard with driveways and inspection platforms for the handling of grapes.

To allow for the new fruit house two of the old Boston & Maine freight houses, Nos. 30 and 31, on Rutherford Avenue were torn down, and in this area a new fruit and vegetable auction terminal 90 feet wide facing on Rutherford Avenue and about 600 feet long was erected. At the Rutherford Avenue end and for a distance of about 100 feet back there is a two-story brick section. On the second floor there are two auction rooms 54 feet long by 45 feet wide, each capable of seating over 200 persons. The remainder of the second floor is divided into office rooms and toilets for the two auction firms. On the first floor there is a restaurant, general toilet facilities, offices for the railroad and auction superintendents and rooms for special storage.

Back of the two-story section there is a single story shed 90 feet wide and 485 feet long in which the crated fruit and vegetables are stacked for display after being unloaded from cars. The floor of this shed is 102 feet wide and 4 feet above the driveways on each side, and is made of reinforced concrete on fill held by retaining walls.

The shed is of steel construction with gypsum roof. On both sides for the entire length there are hand-operated rolling steel doors 8 feet high, which, when raised, leave the entire shed open. Outside of the line of doors the platform is 4 feet wide on one side and 8 feet wide on the other, to facilitate the unloading of the cars and the loading of the trucks.

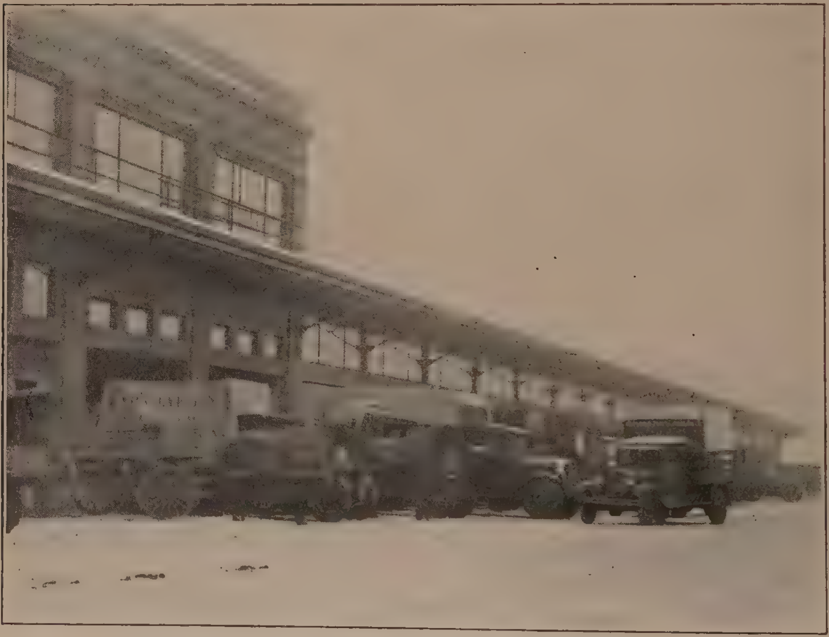


FIG. 5. — FRUIT AND VEGETABLE TERMINAL
View looking from Rutherford Avenue

The fruit terminal is heated by a separate boiler plant built in the rear; radiators are provided for the office rooms and the single story section is heated by unit heaters suspended from the roof trusses.

On the westerly side of the terminal a concrete driveway 80 feet wide extends from Rutherford Avenue the entire length of the building and is continued to the grape yard. Parallel to the fruit house there are two tracks laid level with the pavement. On these tracks the incoming cars are placed and unloaded at night, so that during the day, after the auction, trucks can back directly against the edge of the platform for loading and carrying away the fruit or vegetables. Between the new fruit terminal and the old freight house No. 29, which was remodelled as an overflow for the new building, there are three tracks set in pavement for the same purpose. By using these five tracks 70 cars can be placed at one time for unloading.

Work on this fruit terminal was authorized March 12, 1927, actual construction started on April 5, and the terminal opened for business on August 5.

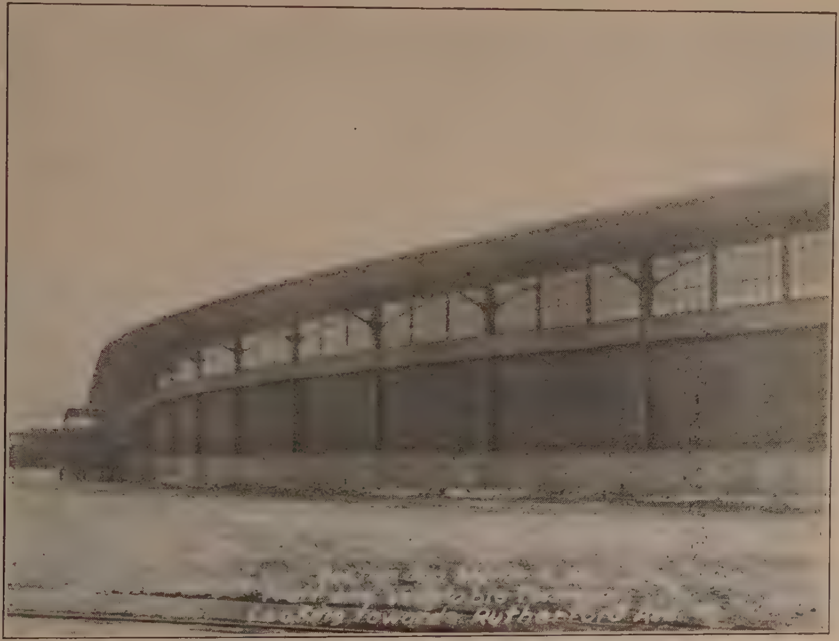


Fig. 6. — Fruit and Vegetable Terminal
View looking towards Rutherford Avenue

In the rear of the fruit terminal and running parallel to Rutherford Avenue is the new grape yard. Here the railroad has constructed three paved driveways, one 950 feet long and two approximately 2,000 feet long, with one track outside and two tracks between the driveways, making six tracks, averaging approximately 1,400 feet long, for accommodating 170 cars. Inspection platforms have been built between the two pairs of tracks.

In this grape yard full cars of grapes are placed and the grapes sold directly from them and removed in trucks. The driveways of this yard connect not only with Rutherford Avenue, but directly through to Front Street and Beverly Street, affording quick access to Boston.

In 1920 there were received 6,975 cars of fruit and 2,000 cars of grapes, which had increased in 1928 to 8,788 cars of fruit and 4,989 cars of grapes.

The construction of the fruit terminal and the grape yards represents an expenditure of over $550,000.

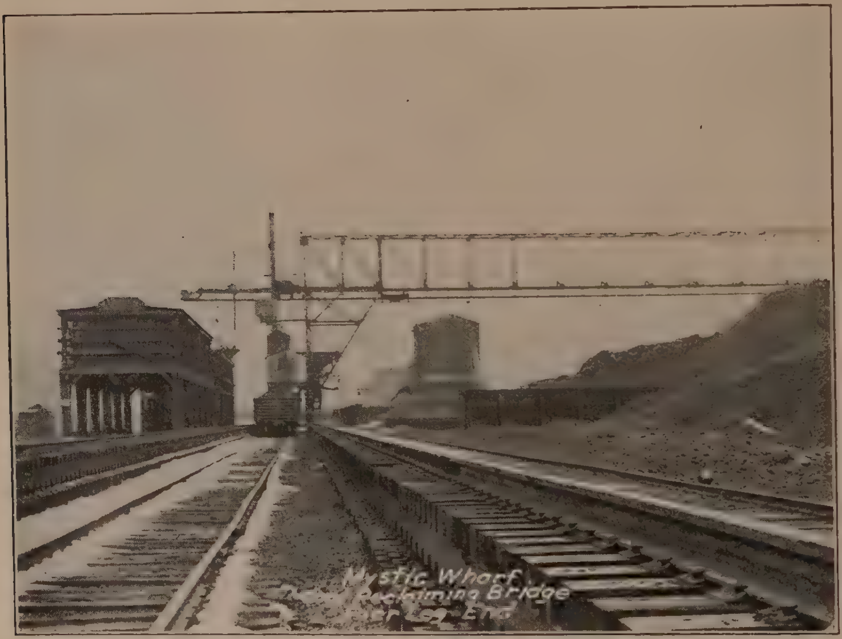


FIG. 7. — COAL HANDLING PLANT — MYSTIC WHARF
Coal reclaiming bridge — pier leg end

COAL HANDLING PLANT — MYSTIC WHARF

In 1926 the Boston & Maine Railroad, at an expense of approximately $500,000, installed at Mystic Wharf one of the largest mechanical layouts for transferring tide water coal from vessels to cars or storage on the eastern seaboard.

The existing facilities at Mystic Wharf at that time consisted of 8 unloading towers, 5 of wood and 3 of steel, carrying 1¼ ton buckets and having a combined average eight-hour capacity of approximately 4,800 short tons. These old towers, operating along Mystic Wharf a distance of 2,000 feet on rails spaced 20 feet center to center, discharged directly into cars placed on each of two tracks running parallel to the face of the wharf. The towers were originally supplemented by a cableway, 3,800 feet long, equipped with buckets for carrying the coal to an area behind the towers, where there was a ground-storage capacity for 60,000 tons which could be increased to 90,000 tons by rehandling. The loading of the coal into cars was accomplished by steam shovel or by locomotive crane with clam shell bucket. Due to the condition of the cableway and the high operating cost, its use had been discontinued for some years, so that coal was stored on railroad land at Middlesex and Mystic avenues, the unloading from cars to the ground and the reloading from the ground to cars being done by locomotive crane. This uneconomical method of operating and the small capacity of the towers led to the construction of the new facilities.

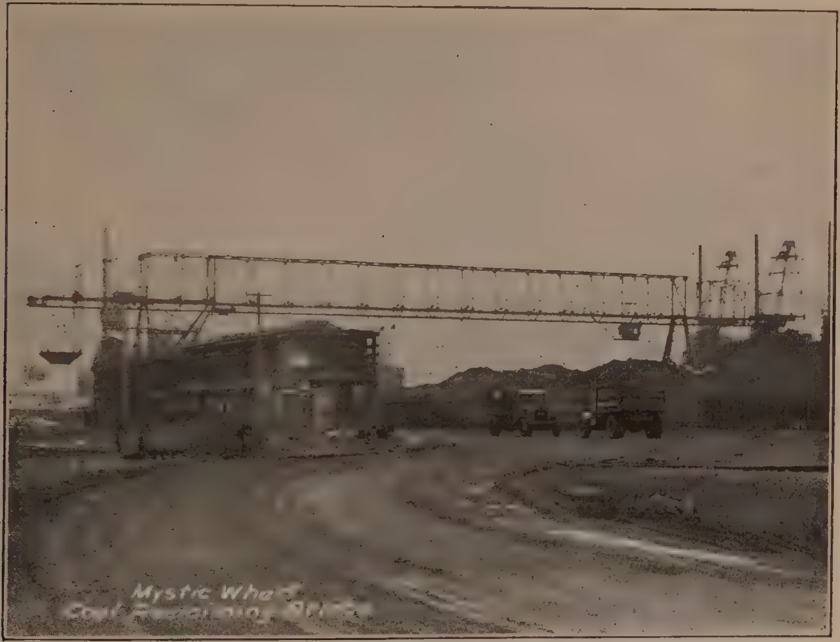


Fig. 8. — Coal Handling Plant — Mystic Wharf
View showing coal reclaiming bridge and unloading towers

The new unloading facilities installed in 1926 consisted of three new steam operated steel towers operating on the rail runways used by the old towers, capable of handling 400 tons per hour, using grab buckets having a load capacity of 6,000 pounds. At the same time two of the old steel towers were remodeled and equipped with 3,000-pound buckets, thus providing a total of five unloading towers. Since then the railroad has purchased two more towers similar to those installed in 1926, so that there are five unloading towers with 6,000-pound buckets and two towers with 3,000-pound buckets, one of these latter being kept in reserve, the unloading capacity being double that of the old facilities.

Each tower is supported by 16 double flange wheels 30 inches in diameter, grouped 4 at each corner, 8 of the wheels being connected through steel spur and worm gearing to a propelling engine which has sufficient power to move the tower in either direction at the rate of 50 feet per minute. Each tower can be secured against movement along the track by fastening to the rails at each corner a manually operated, screw type, rail clamp. Each tower is also equipped with a steam operated car puller for use in moving coal cars to and away from the tower, each puller being able to move a train weighing 980 tons, at the rate of 50 feet per minute.

As the coal is hoisted from the ships by the buckets, it is discharged directly into a hopper of 60 tons' capacity located in the towers, thus affording temporary storage so that the unloading of vessels can continue while cars for loading are being moved or shifted. From this hopper, through a system of chutes and steam-operated gates, the coal is discharged directly into cars on either of the two tracks parallel to the face of the wharf, or can be discharged by means of a belt conveyor at the rate of 400 tons per hour into a cushion pile back of the towers.

This cushion pile is approximately 100 feet from the face of the wharf, which allows the placing of 20 tons per lineal foot. From the cushion pile the coal is handled for storage and later for reclaiming and reloading by means of a 440-foot traveling bridge for stocking and reclaiming the coal, operating on runways 935 feet long, laid parallel to the face of the wharf and to the cushion pile, the bridge being equipped with a 6-ton grab bucket. This bridge is a 440-foot Pratt truss, supported on two towers 315 feet on centers, which rest on the runways referred to above, the nearest runway being 125 feet from the face of the wharf. The grab bucket is suspended from a trolley carriage, which in turn operates on a 425-foot trolley track beneath the floor structure of the bridge. With coal piled 40 feet high under the bridge there is a ground storage capacity of approximately 240 tons per linear foot of runway.

The towers supporting the bridge are of two distinct types, one a single pier leg which is rigidly connected to the bridge and designed to restrict sway or longitudinal thrust, and the other a simple shear leg or rocker bent tower with a pivoted connection at the bridge so as to reduce the stresses in the bridge and towers that would be set up if one end of the bridge was moved ahead of the other. In addition to these two towers the bridge is also fitted with an auxiliary leg called a portal leg, which is located 16 feet outside the pier leg tower, to which it is rigidly connected. This auxiliary leg with the pier leg serves to support the operating machinery of the bridge and also rests on a rail runway.

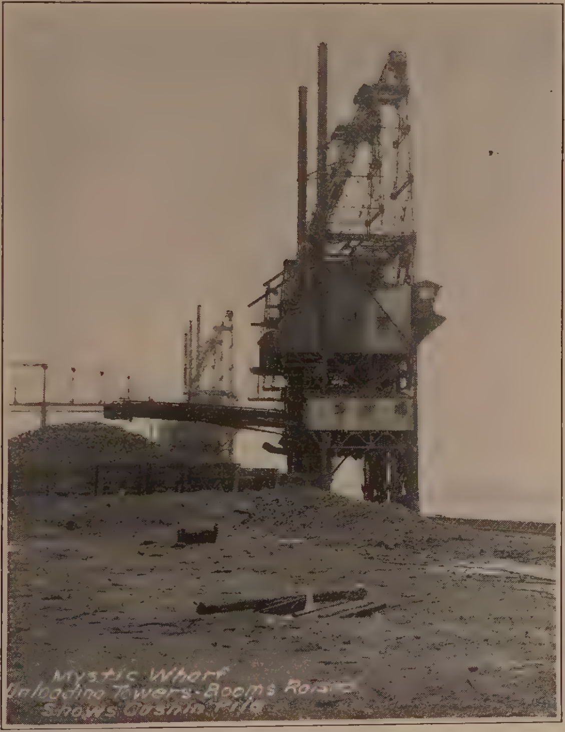


Fig. 9. — Unloading Towers
View shows cushion pile

In order to provide for the movement of the bridge the towers are carried on eight 16-inch chilled tread wheels. The movement of the bridge along the runways is effected by 10-inch by 12-inch reversing type steam engine, directly connected to the wheels of the bridge towers through spur and bevel gearing and steel shafting, and it is possible to move the bridge along the runway in either direction at the rate of about 50 feet per minute. In order to hold the bridge at any location or to prevent its movement while coal is being handled both the pier leg and shear leg towers are equipped with two automatic clamps.

The bridge has a maximum capacity for transferring coal from the cushion pile to the main storage pile at the rate of 700 tons per hour, and from the storage pile to a 60-ton steel hopper at the rate of 600 tons per hour. This hopper is located within the pier leg of the bridge and provided with gates and chutes for the purpose of loading coal into cars on either of the two tracks beneath the hopper. There is also an auxiliary hopper for use in discharging the coal into coal pockets along the ground, from which it can be dumped into trucks for local distribution.

Of this storage space, having a total frontage of 935 feet, 235 feet is reserved for railroad storage, providing a storage capacity for approximately 50,000 tons, while the remaining area, with 700 feet frontage, provides a storage capacity in the neighborhood of 125,000 tons, which has been leased to two coal companies for commercial delivery of coal by trucks and to the American Briquet Company, which uses an area for storage in connection with their plant nearby, where coal briquets are manufactured and shipped out either by truck or rail.

Flood Lighting

While there have been many other minor improvements, the discussion of which cannot be covered at this time, it is felt that mention should be made of the interesting exemplification of the successful use of floodlight projectors for railroad work, as installed in the terminal.

In this installation fourteen 85-foot towers have been located at various strategic points throughout the terminal, with groups of projectors, ranging in number from eight to eighteen, located on each tower. The height and location of the towers, together with the choice of proper reflectors and lenses, have taken care of any objectionable glare. The types of projectors used are the Crouse-Hinds Type LCE-20 and General Electric Type L-24. The lights at the towers illuminate for varying distances to meet the needs, — the greatest distance being about 2,000 feet. The flood lights have mirror glass reflectors and are equipped with plain, diffusing or spread lenses, all three types being used on the installation. Mechanical stops preclude any changes in projector settings.

A high level of even illumination with complete absence of sharp shadows has been provided, and particularly in the two classification yards where the automatic car retarders are located.

This installation has been in operation about two years and has successfully solved the problem of speedy traffic handling at night, with considerable increase in the safety factor and with minimum of maintenance costs.

All these improvements have been carried on under the direction of the engineering department of the Boston & Maine Railroad, which since January 1, 1927, has been under the direct supervision of W. J. Backes, chief engineer.

INDUSTRIAL DEVELOPMENTS

In addition to the improvements made by the Boston & Maine Railroad, there has been during the period discussed a very material industrial development, either on or adjoining the Boston terminal served by tracks of the railroad, and it is felt that in any discussion of the terminal improvements mention should be made of these developments.

In 1925 the Boston & Maine Railroad sold to the Ford Motor Company a parcel of land containing over thirty-one acres located on Middlesex Avenue in Somerville, where this company has erected a large assembling plant, with space for a second unit.

In 1927 the Boston & Maine Railroad sold to the First National Stores, Inc., about twelve acres of land along Mystic and Middlesex avenues in Somerville, where this company erected a plant for the concentration of all its delivery work, as well as a plant for baking purposes. In 1928 a further area of four acres was sold to this concern, and since then the plant has been extensively increased to handle meats and produce, including refrigerating facilities.

In 1927 the Boston & Maine Railroad sold to the American Oil Products Company about 79,000 square feet of land near Washington Street, Somerville, where this company has erected a plant for receiving and distributing road and other oils.

In 1927 the Boston & Maine Railroad leased to the American Briquet Company approximately 100,000 square feet of land on Mystic Wharf, where this company has erected a plant for the manufacture of coal briquets. The coal, received on boats, is unloaded by the railroad through its new coal handling plant into the storage area, and is taken from this storage by the Briquet Company, through its own equipment, and manufactured into briquets and then shipped for consumption.

In 1928 the Boston & Maine Railroad sold to the U. S. Gypsum Company 233,000 square feet of land at Mystic Wharf, where the Gypsum Company has erected a large plant for receiving by boat raw gypsum, which is stored and shipped away, as well as being used for the manufacture of some of its products.

In 1928 the Boston & Maine Railroad sold to H. P. Hood & Sons about 130,000 square feet of land on Rutherford Avenue, where this concern has recently opened one of its most modern milk terminals.

In 1928 the Boston & Maine Railroad sold to the North Station Industrial Building, Inc., an area of land containing about 45,000 square feet, located on Causeway Street between Haverhill and Beverly streets, which was the location of the old Fitchburg Railroad Station which was built in 1846. The railroad removed the old station, using the stone, as previously noted, for the construction of a sea wall on the north side of the Charles River, and the new owners have erected a large terminal warehouse thirteen stories in height, with a frontage of 110 feet on Causeway Street, running back 380 feet. This building, with track connections, has been built in conformity with the new station and the new hotel to form a very imposing group of buildings on Causeway Street. The second floor of this building has been leased to the Boston Madison Square Garden Corporation as an annex to the coliseum, and is connected with it by a bridge over Haverhill Street.

In 1928 the Boston & Maine Railroad sold to the Beacon Warehousing Trust about 17,000 square feet of land in Somerville, opposite the Winter Hill Station, on which there has been erected a modern branch house for the distribution of miscellaneous merchandise by Reid, Murdoch & Company.

In 1928 the Boston & Maine Railroad sold to Lucius H. Beyer about 25,000 square feet of land in Somerville, on which the American Radiator Company has established a branch warehouse.

In 1929 the Boston & Maine Railroad sold to the Penn Oil Company an area of 58,000 square feet of land in Somerville near Mystic Avenue, where a large plant has been erected for distribution of gasoline.

In 1929 the Boston & Maine Railroad leased to John McCourt Company about 39,000 square feet of land in Cambridge near Lechmere Square, where a plant has been erected for receiving, preparing and distributing a large quantity of the road building material used in the vicinity of Boston.

In addition there have been several important industrial developments which, while not on railroad property, have track service, the principal ones being the large increase in the Schrafft Plant on the Mystic Wharf branch; the Wiggin Lumber terminal on this same branch, and a plant being erected by John Morrell Company in East Cambridge along the Northern Artery.

Discussion

PROF. C. FRANK ALLEN:* I wonder whether Mr. Shepherd would care to say anything with respect to the economics of this large and expensive development.

MR. SHEPHERD: I am unable to give any exact figures. When we first started on the general program for rebuilding the terminal in 1926–27, no authority was granted for new work unless a 15 per cent return could be shown on the investment. I am inclined to think that that figure will hold over all improvements. There has been a large saving from the decrease in locomotives formerly used in the classification work. I believe 56 locomotives were dispensed with when the new classification yards were opened.

JOHN B. BABCOCK:† It seems to me that there are two features of interest in connection with the Boston & Maine improvements: first, the actual things which have been accomplished and the engineering detail which made possible such a development; and second, the vision with which it was conceived. This is an appropriate time to speak of the late George Hannauer, president of the Boston & Maine, to whom such a large share of credit should be given. He came to Boston as a consultant several years ago, when the railroad wanted the advice of a practical operating man familiar with terminal developments. As a result of his recognized ability Mr. Hannauer was later asked to become president, and to carry out the large scale plans he had recommended. Those who have had any connection with the Boston & Maine, both within the organization or on the outside, will testify to the character of the service Mr. Hannauer gave to the railroad. While it is sad that he did not live to see it completed, these improvements will stand as a wonderful tribute to his memory.

LEWIS E. MOORE:‡ If I may open up a little different phase of the subject, I would like to ask Mr. Shepherd whether any attempt has been made by the Boston & Maine to deliver less than carload freight directly to the consignee, or is it simply unloaded in the warehouse to remain there until called for? Providing storage room for freight means tieing up considerable storehouse area and considerable capital unproductively. In London, England, I know the railroads themselves distribute the freight, and consequently only a very small storage capacity is required in the freight houses.

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‡ Consulting Engineer, 73 Tremont Street, Boston, Mass.

MR. SHEPHERD: I am not very familiar with this part of the railroad operation. While there has been no large attempt towards direct delivery, the railroad, through the Boston & Maine Transportation Company, which is a subsidiary, has for some few years handled door to door delivery and door to freight house and freight house to door delivery in certain localities. The average freight house is not built for storage and must be emptied between deliveries each day in order to avoid congestion, and I find that this is largely done, being advised that in Boston 60 per cent of the deliveries are moved the day they arrive. We have now one unit of concrete warehouse construction for storage of material during transit, and the plans contemplating extension into the Charles River will include quite a development of storage warehouse facilities.

J. PARKER SNOW:* Before discussing the details of the paper, I want to express my commendation to the speaker of the evening for his fine description of the stupendous improvements made in the terminal of the Boston & Maine Railroad. The magnitude of the work done is a revelation to me. It is in sharp contrast to what used to be the rule in my day on this railroad.

I am not much interested in the passenger development as, in my opinion, passenger transportation is a diminishing factor in the business of steam railroads. I say steam railroads, but I do not cut out lines now operated by other than steam power on which steam locomotives were formerly used. I think it well within the possibilities that during the next few years our trains may be electrified through the agency of the oil-electric locomotive. This, however, will not change the conditions in regard to passenger traffic.

The work done and being done as shown on the map before us is in line with bringing the terminal of this road up to present day standards. In the old days, when I was connected with the road, we worked on a smaller scale, in fact we knew nothing about many of the appliances described here tonight.

It is interesting to learn of the great areas of original water surface that have been filled, constituting a very large percentage of the area now occupied by terminal yards and facilities; also of the portions of Charles and Millers rivers now being filled and the further spaces for which authority has been obtained for filling. It recalls the drastic State regulations in force forty years ago, which required the scrupulous preservation of every cubic foot of tidal space; so that if we wanted to drive a pile in tide water we must pull an old pile or excavate between high and low water a volume of mud equal to the volume of the pile driven. Volume of tidal flow was then a fetish of the War Department which had to be obeyed by railroad engineers. The great encroachments on the tidal basin now being made leads to the hope that navigation above Charlestown Bridge will sometime be discontinued and the river below Lechmere Dam carried by covered culvert ways so the whole basin area can be used for the traffic, rail and highway, on the northeast, north and northwest sides of Boston.

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* Consulting Engineer, 18 Tremont Street, Boston, Mass.

The Boston & Maine Railroad terminal is but part of the real Boston terminal problem, which if properly solved would, I believe, make this the best ocean shipping port on the Atlantic coast of the United States. The topography of this region, the natural conditions, the grouping of our business, industrial and residential areas, and our abundant financial and insurance recourses, all favor the proper solution of this problem without the expenditure of much new capital. A first essential element in this solution is the unified ownership of the three railroad lines coming into Boston, the Boston & Maine, the Boston & Albany and the New Haven, as has been advocated by Mr. Buckland, director of the New Haven. This combination may be possible under the present urge for consolidations that seems so active now. With this accomplishment the rest of the solution is straight engineering, easily executed in a way that would render the transfer of freight between land and water carriers and to and from local industries, from shippers to consignees, cheap enough to attract trade here rather than at congested New York.

Boston is the trade center of New England. Enlarging its trade will enlarge the business of every section of the whole region more than any other possible development.

OF GENERAL INTEREST

M. I. T. OFFERS COURSE IN RAILROAD OPERATION

Boston & Maine Railroad Co-operates with Massachusetts Institute of Technology in Establishment of New Five Year Course — Students to Get Seventy Weeks of Practical Work with Railroad.

*By John B. Babcock, 3d**

The recent establishment of a course in Railroad Operation by the Massachusetts Institute of Technology in co-operation with the Boston & Maine Railroad was in recognition of the increasing importance of an engineering training for those desiring to enter the field of railroad transportation. Its object is to provide a thorough training in the principles of modern science at the Institute and practical experience in the operating department of a progressive railroad.

Many important changes have taken place in transportation since the return of the railroads in 1920 from Federal control to private management. The rapid development of highway transportation has changed the character of railroad traffic, resulting in a decrease in passenger business and in local freight traffic. The total freight tonnage and the average length of haul have increased during the same period. To furnish adequate rail transportation it has been necessary to increase car loads and train loads, to maintain faster road schedules, and to expedite terminal operations. At the same time, it has been necessary to meet the competition of automotive transportation in the field of passenger and short-haul freight traffic by the use of gasoline rail cars, busses and motor trucks.

The Boston & Maine Railroad may be cited as an example of the intensive development of a railroad property to meet these rapidly changing conditions of the past few years. This road has built modern hump yards, operated with car retarders, at two of its important freight terminals, — Mechanicville, New York, and Boston, Massachusetts. Today freight trains arriving from the West are classified at Mechanicville and are ready to leave in from one and one half to two hours, and the 200 mile run to Boston is made in eighteen hours, providing freight service comparable to service furnished by the express companies a few years ago. New motive power has been put in service, built for efficiency and sustained power. Tracks have been improved by the use of heavier rails and rock ballast, and bridges have been strengthened to accommodate the heavier locomotives.*

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* Professor of Railway Engineering, Massachusetts Institute of Technology, Cambridge, Mass.

While the railroads have been engaged in this intensive development of their properties, what have they done in the education and training of personnel competent to fill the responsible supervisory positions? Does an engineering education provide the best training for those who desire to enter the railroad field? To what extent can the colleges assist in this work?

A serious endeavor to answer these and correlated questions may be found in an exhaustive report entitled "Transportation — A Survey of Current Methods of Study and Instruction and Research and Experimentation," by Topping and Dempsey, prepared for the use of the Committee on Transportation of Yale University, 1926.

For many years the Massachusetts Institute of Technology has offered railroad subjects of an engineering character, presented with sufficient breadth of view to enable students entering the engineering department to have a basic knowledge of the co-ordinated activities of the other departments of the railroad. About two years ago the Boston & Maine Railroad suggested that a co-operative course might be established between the Institute and the Railroad which would be of mutual benefit. As the result of a series of conferences by a joint committee representing the Institute and the Railroad, such a course was established, and students are now registered in each of the four undergraduate years.

The course, which leads to the master's degree, consists of two years at the Institute, followed by three years of co-operative work in which the student alternates between the Institute and the Railroad. The course schedule at the Institute includes the fundamentals of civil, electrical and mechanical engineering, together with certain railroad subjects which are co-ordinated with the actual practice on the Railroad. Ninety per cent of the work of the four undergraduate years is devoted to basic engineering and general studies, and about 10 per cent to railroad subjects. In the fifth year the students will take graduate work and research, part of it on railroad matters and part along administrative and general engineering lines.

During the co-operative periods the student receives practical experience as a paid employee of the Railroad for four terms of about seventeen weeks each, including work in the following departments: Engineering, Mechanical, Operating and Executive. The work is a part of a definite educational plan by which the student will have an opportunity to take part in all of the important phases of railroad operation. A member of the Institute staff acts as co-operative officer, and it is his duty to co-ordinate the work at the Institute and at the Railroad.

The important features of this new railroad course which should be emphasized are:

1. The co-operative course in Railroad Operation was established at the suggestion of the Boston & Maine Railroad, in recognition of the desirability of a fundamental engineering

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* An article entitled "Fast Freight Transportation," by Lawrence Richardson, Chief Mechanical Officer, Boston & Maine Railroad, printed in the November, 1928, B. S. C. E. JOURNAL, describes the recent operating improvements made on the Boston & Maine Railroad.

background for those wishing to enter the field of Railroad Transportation.

2. The educational and administrative principles are identical with those of the co-operative course in Electrical Engineering, which has been in successful operation at the Massachusetts Institute of Technology for the past ten years, the most important feature being that the Institute provides the students with a fundamental engineering training, and the Company gives him an opportunity to get practical experience through a well co-ordinated work program.

3. The success of this course will depend upon the calibre of student which it attracts, on the soundness of his training at the Institute, on the character and scope of the practical experience he receives on co-operative work, and finally, on the opportunity which is afforded him of demonstrating his ability within a reasonable period of time.

PROCEEDINGS OF THE SOCIETY

MINUTES OF MEETINGS

Boston Society of Civil Engineers

December 18, 1929. The regular meeting of the Boston Society of Civil Engineers was held in Chipman Hall at 7.15 P.M., and was called to order by the President, Frank E. Winsor.

About ninety members and guests were present.

The President reported the death of Edwin H. Lincoln, who died December 8, 1929. He had been a member since February 16, 1887.

It was *voted*, "That the Board of Government be authorized to use the current income from the Permanent Fund to such an extent as necessary in payment of the current expenses of the Society."

This matter was acted upon favorably at the meeting of the Society on November 20, 1929.

The President then introduced as the speaker of the evening Mr. Frank C. Shepherd, Consulting Engineer to the Boston & Maine Railroad, who presented a paper on the "Recent Terminal Improvements of the Boston & Maine Railroad."

These improvements were made possible by the consolidation of four former separate railroad companies under one ownership. The new freight house facilities, classification yard, engine terminal, fruit and vegetable terminal, coal handling plant at Mystic Wharf, industrial developments and the new North Station passenger terminal, including the coliseum, were outlined.

At the conclusion of the paper a number of questions were asked regarding these undertakings.

The meeting adjourned about 9 P.M.

Everett N. Hutchins, *Secretary.*

APPLICATIONS FOR MEMBERSHIP

[January 20, 1930]

The By-Laws provide that the Board of Government shall consider applications for membership with reference to the eligibility of each candidate for admission and shall determine the proper grade of membership to which he is entitled.

The Board must depend largely upon the members of the Society for the information which will enable it to arrive at a just conclusion. Every member is therefore urged to communicate promptly any facts in relation to the personal character or professional reputation and experience of the candidates which will assist the Board in its consideration. Communications relating to applicants are considered by the Board as strictly confidential.

The fact that applicants give the names of certain members as reference does not necessarily mean that such members endorse the candidate.

The Board of Government will not consider applications until the expiration of fifteen (15) days from the date given.

Antonelli, Constantino, Quincy, Mass. (Age 25, b. Italy.) Had a course in Franklin Union in structural and ornamental iron from 1922–28. With A. L. Smith Iron Works from March, 1923, to February, 1929, designing, detailing and estimating; with Marden-Orlando Company, Inc., from February, 1929, to date as estimator and engineer. Refers to *O. D. Chiesa, Edward Grossman, B. E. Sullivan, A. L. Wannlund.*

Burke, Lawrence Smith, Boston, Mass. (Age 20, b. Providence, R. I.) Attended Mechanic Arts High School and then entered Wentworth Institute, graduating in June, 1929, and is at present taking an evening course in bridge design at Franklin Union. From July 1 to August 1 was with McFarlane & Abbott, electrical constructors, as temporary tracer and is now with Cleverdon, Varney & Pike, as draftsman. Refers to *C. W. Banks, H. S. Cleverdon, L. M. Hersum, E. D. Kingman, W. F. Pike.*

Covil, William Foulds, Somerville, Mass. (Age 26, b. New Britain, Conn.) Graduate of Tufts College with degree B.S. in civil engineering. From June, 1926, to November, 1928, with the engineering department, town of Arlington; now with New England Power Construction Company, in estimating department. Refers to *H. P. Burden, W. C. Custer, J. J. Germaine, E. G. Lee.*

Dinnan, Francis T., New Haven, Conn. (Age 24, b. New Haven, Conn.) Now a senior at Northeastern University. During the co-operative periods has been employed by Simpson Brothers Company as rodman; Worcester County Engineering department as rodman; rodman and transitman in town of Framingham; also rodman for New York, New Haven & Hartford Railroad. Refers to *H. B. Alvord, C. O. Baird, J. W. Ingalls, W. E. Nightingale.*

Dionne, Maurice Joseph, Braintree, Mass. (Age 21, b. New Bedford, Mass.) Graduate of New Bedford High School and immediately upon graduation worked for J. I. Paulding Company, manufacturers of electrical appliances. Entered Northeastern University in January, 1927, and during that summer worked for F. C. Taylor & Co., dredging engineers, on the Round Hill Airport with a level party, and re-entered Northeastern in October, 1927. During co-operative periods has been employed by George H. Wetherbee in Braintree as transitman; and with John J. Drinkwater, C.E., in Braintree, as draftsman and computer. Refers to *H. B. Alvord, C. O. Baird, J. W. Greenleaf, Jr., Ernest S. Hill, J. W. Ingalls.*

Donovan, William F., Quincy, Mass. (Age 46, b. Boston, Mass.) Graduate of Mechanic Arts High School and courses in Franklin Institute, 1905–07, office assistant, Stone & Webster; 1907–10, transitman for Charles River Basin Commission; 1910–12, with Harbor and Land Commission as transitman; 1912–16, transitman and assistant engineer for Director of Port of Boston; 1916–20, assistant engineer on Boston Dry Dock; 1920–23, construction of Boston Airport, investigations for traffic tunnel, sea wall and alterations on Commonwealth Pier; 1924 to date, resident engineer, Massachusetts Department of Public Works, on major projects of roads and bridges; at present resident engineer on Alewife Brook Parkway, Cambridge. Refers to *R. W. Coburn, A. W. Dean, J. N. Ferguson, E. N. Hutchins, F. T. McAvoy.*

Libby, Donald Francis, Everett, Mass. (Age 20, b. Everett, Mass.) Is a student at Northeastern University. During co-operative periods has worked for Whitman & Howard as rodman; E. M. Brooks, Newtonville, as transitman; and as draftsman with Malden Electric Company. Refers to *W. J. Alcott, Jr., H. B. Alvord, J. W. Ingalls, W. E. Nightingale.*

LOWE, JOHN HOWARD, Lynn, Mass. (Age 22, b. Lynn, Mass.) Graduate of Lynn High School and now a student at Northeastern University. During co-operative periods has been radio service man for C. V. Stackpole & Son, Inc., and during co-operative periods for a little over a year, for Aspinwall & Lincoln. Refers to *H. B. Alvord, C. O. Baird, L. A. Chase, J. W. Ingalls.*

MICHELSON, JUSTIN J., Boston, Mass. (Age 24, b. Chelsea, Mass.) From September, 1925, to date, has been sales engineer for a manufacturer's agent. Refers to *D. B. Fraser, Edward Grossman, J. J. Harty, Mark Linenthal.*

MURPHY, ARTHUR RICHARD, Brockton, Mass. (Age 21, b. Brockton, Mass.) Graduate of Brockton High School and Wentworth Institute, where he took the architectural course. Was employed for a time with Peterson & Neville as draftsman, and since leaving them has been with Maurice A. Reidy, Consulting Engineer. Refers to *C. W. Banks, F. F. Hampe, E. D. Kingman, L. J. Tracy.*

O'CONNOR, EDWIN JOSEPH, Danvers, Mass. (Age 21, b. Danvers, Mass.) Is a student at Northeastern University. During co-operative periods is working with Aspinwall & Lincoln. Refers to *C. O. Baird, L. A. Chase, W. H. Connor, H. G. Gray, C. A. Wolfrum.*

PETERSON, ARTHUR WILLIAM, Brockton, Mass. (Age 20, b. North Easton, Mass.) Is a student at Northeastern University. During co-operative periods has worked for Boston Consolidated Gas Company. Refers to *H. B. Alvord, C. O. Baird, J. W. Ingalls, W. E. Nightingale.*

WEXLER, DAVID, Brookline, Mass. (Age 30, b. Fall River, Mass.) Graduate of M. I. T., 1920, in civil engineering. Employed by Truscon Steel Company, 1920–21, as draftsman and concrete designer; a member of firm of Winebaum & Wexler since 1922. Refers to *Hyman Felderman, Edward Grossman, G. H. Smith, C. M. Spofford.*

For Transfer to Grade of Member.

LANGTRY, CHESTER F., Framingham, Mass. (Age 27, b. Boston, Mass.) Graduate of Framingham High School and Northeastern Evening School. Part-time employment with J. J. Van Valkenberg in engineer's office, town of Framingham. Refers to *W. H. Connor, F. L. Flood, H. A. Mayo, G. H. Meserve, Jr., J. J. Van Valkenberg.*

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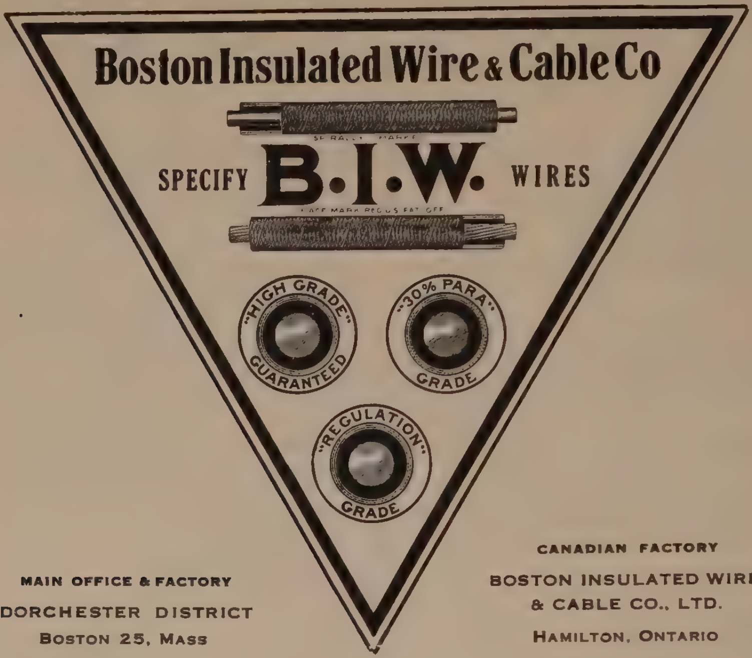

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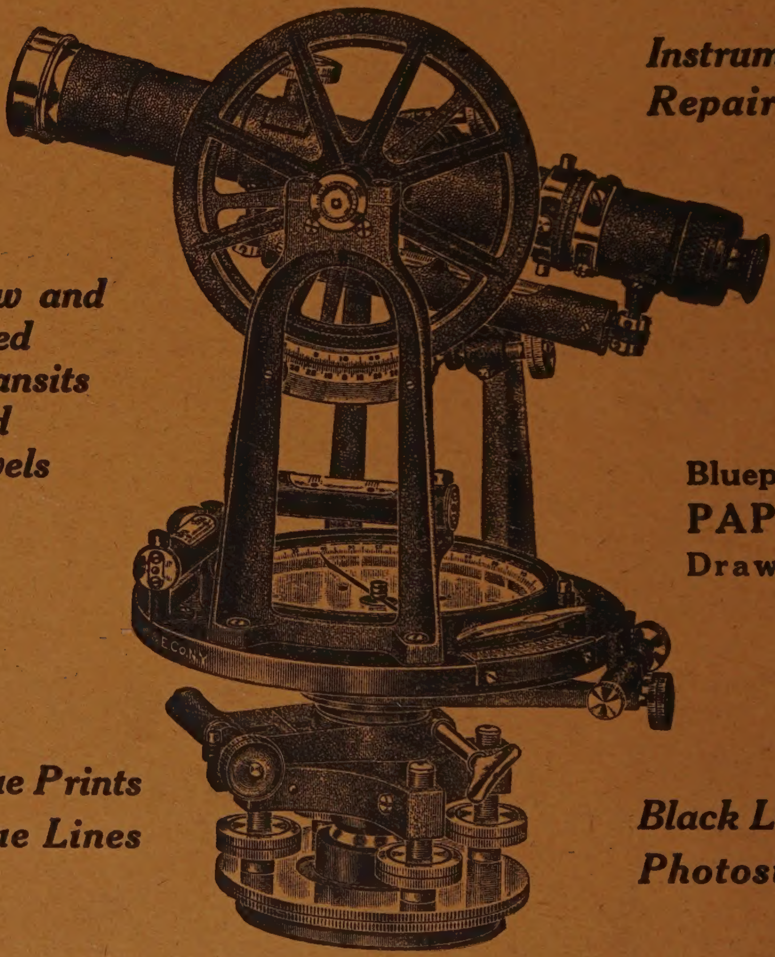

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